

N E R R S

Graduate Research Fellowships



10 Years of Research, Training, and Policy



NATIONAL
ESTUARINE
RESEARCH
RESERVE
SYSTEM

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Published November 2007 by NOAA Office of Ocean and
Coastal Resource Management
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Estuarine Reserves Division
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Editors: George Cathcart and Alison Krepp
Design: Ben Keefer

National Estuarine Research Reserve System Graduate Research Fellowships, 1997-2007 10 Years of Research, Training and Policy

The National Estuarine Research Reserve System's (NERRS) Graduate Research Fellowship Program was established in 1997 to support graduate students interested in coastal and estuarine sciences. By providing stipends, a living laboratory and a broad network of fellow scientists, the reserve system aims to encourage and enable talented young scientists to contribute to the knowledge base, provide the science to support coastal decision-making and train future coastal scientists and policy-makers.

The program has been an unqualified success. This publication documents some of the achievements of the Graduate Research Fellows over the past 10 years. In the following pages, you will find detailed profiles of five past fellows whose work fulfills the promise of the program. Similar stories could be told about virtually any of the more than 200 graduate students who have been Graduate Research Fellows. You will also find in these pages vignettes and statistics that illustrate the breadth and depth of this renowned program.

About the Program

One of the largest graduate programs supported by the National Oceanic and Atmospheric Administration (NOAA), the GRF program has supported more than 225 students since 1997. Fellows conduct their master's and doctoral research in the 27 National Estuarine Research Reserves located in 23 states and Puerto Rico – truly living laboratories for scientists, teachers and students.

The National Estuarine Research Reserves are partnerships between NOAA and the coastal states. The reserves are managed and protected by state agencies and universities for long-term research, education and stewardship.

NOAA provides matched operations funding as well as program guidance and technical support, but management priorities address local and regional issues and needs.

GRF projects support the reserve system by studying pressing estuarine management topics with local, regional and/or national significance. Fellows also engage with reserve staff members to contribute to their host reserves' research and monitoring programs, while gaining hands-on skills to complement their academic studies.

Fellowship projects enhance scientific understanding of reserve ecosystems, provide information needed by reserve managers and coastal management decision-makers, and improve public awareness of estuarine ecosystems and estuarine management issues.

Reserve system priority research areas include:

- nutrient dynamics and/or effects of non-point source pollution and eutrophication;
- habitat conservation and restoration;
- biodiversity and/or effects of invasive species;
- mechanisms for sustaining estuarine ecosystems;
- economic, sociological and anthropological research applicable to estuarine ecosystem management.

The last focus area was added to the list of eligible topics in 2003.

During the first decade of the program, more than half of the fellowship projects have focused on either habitat restoration and conservation or nutrient dynamics and non-point-source pollution. Projects funded under the theme of sustaining estuarine resources focus on topics such as hydrology, contaminants, population and community dynamics, sea-level rise, sediment dynamics, and anthropogenic effects on natural resources.

Projects within each of the focus areas have been evenly balanced geographically.

Because the fellowships are based at a reserve, students have the opportunity to engage with experts on the reserve staff and use reserve resources such as water quality and weather data loggers and GIS capabilities to accomplish their work, providing a truly collaborative and comprehensive graduate experience.

About the Fellows

More than a million dollars are awarded each year on a competitive basis to graduate students admitted to or enrolled in a full-time master's or doctoral program at accredited U.S. universities. Two fellowships are funded at each reserve every year.

Fellows are selected based on the quality of the proposed research, the applicability of the topic to the reserve system's scientific focus areas and resource management goals, and the student's academic record (based on the applicant's transcripts and two letters of reference). Fellows can receive grants for up to three years of research.

A majority of the students funded are pursuing their PhDs. All fellows actively participate in national, regional, and local professional meetings to share research findings. The program promotes sharing research results within the reserve system as well as through professional networks.

A large number of current and past fellows present their work at the international Estuarine Research Federation conference held biannually in the autumn. NOAA hosts a GRF reception at this meeting to provide an opportunity for current and past fellows to network and share their experiences. Fellows also share project information with local reserve constituencies and academic partners, and most publish their work in highly regarded peer reviewed journals such as *Estuaries*, *American Scientist*, *Conservation Biology* and *Oecologia*.

Fellows' academic merit and standard of achievement are high and their work is often recognized for their significance to coastal management. For example, six NOAA Graduate Research Fellows have been awarded the Walter B. Jones Memorial Award for Excellence in Coastal and Marine Graduate Study since the inception of the program.

The Jones Awards honor those who exemplify innovation, resourcefulness, leadership and a commitment to balancing the human use of America's coastal and ocean resources with the needs of the resources themselves.

Upon graduation, fellows find relevant employment in state and federal government, consulting firms, and academia. Several fellows in academia are now nurturing their students' academic careers through the GRF program.

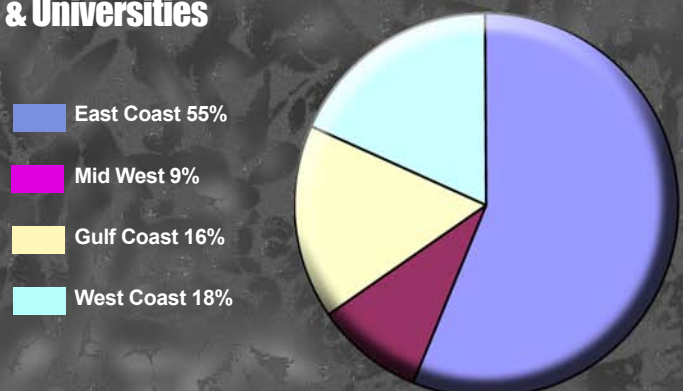
Those who have gone into private or public research firms also have continued to use the reserves as platforms for research and encouraged the use of reserve data and infrastructure, thus validating the value of place based multi-disciplinary reserve programs.

The National Estuarine Research Reserve Graduate Research Fellowship Program provides a remarkable opportunity for students to follow their academic passions in living laboratories, gain hands-on experience working with reserve research and monitoring programs, and contribute to scientific understanding of estuaries and coastal management in a collaborative and supportive environment.

Over the past 10 years, Graduate Research Fellows have come from a number of academic institutions all over the United States, including Hawaii, Alaska, and Puerto Rico. The top sources of successful proposals:

1. University of South Carolina
2. Brown University
3. William and Mary
4. University of New Hampshire
5. University of California System
6. Rutgers University
7. University of Delaware
8. Boston University
9. University of Maryland
10. University of Georgia

Regional Distribution of Graduate Research Fellows' Colleges & Universities



Jonathan Grabowski

North Carolina, 1997-2001



The first class of NOAA Graduate Research Fellows was named in 1997. It comprised 35 graduate students whose research proposals won them financial support to pursue their burning questions about coastal environmental issues at the then-21 National Estuarine Research Reserves around the country.

Jonathan Grabowski, who wanted to find out what difference it made where oysters lived in the intertidal zone in North Carolina estuaries, was one member of the charter class. His work in the Rachel Carson component of the North Carolina Reserve provided valuable insights into the ecological importance of the location of oyster reefs and launched his career as a respected marine scientist.

Grabowski, a graduate student at the University of North Carolina's Institute of Marine Science, first developed an interest in barrier island ecology as an undergraduate at Duke University with a double major in biology and economics. His undergraduate work provided valuable perspectives and foundations for his graduate studies and his continuing career.

Grabowski began his doctoral research with the simple observation that oyster reefs in North Carolina have historically been located in three places, the intertidal zone adjacent to salt marshes, between salt marshes and seagrass beds, and on mud flats isolated from vegetated habitats. This made him wonder whether there was an ideal location for restoring oyster reefs in order to maximize their value to the ecosystem?

The question was intriguing enough to win him the NOAA Graduate Research Fellowship.

There was little known at that time about how the landscape setting of oyster reefs influenced the recruitment and utilization of juvenile fish or the "ecosystem services" of oysters such as water filtration.

Grabowski's work during his three-year Graduate Research Fellowship filled that knowledge gap.

His painstaking observation, data collection and analysis demonstrated that the landscape setting of an oyster reef has a major influence on the community that recruits to and utilizes the restored reef habitat.

Grabowski's research revealed two key findings. The first was that only reefs on mud flats enhanced juvenile fish abundance. The second was that reefs located close to vegetated habitats performed the same ecological functions as the neighboring vegetated habitats.

Grabowski was able to conclude not only that the settings of these reefs are important but also that the location of restoration projects could potentially augment fish productivity in estuaries. This conclusion resonated with the science and management communities as well as in a fishing industry where 90% of the seafood species caught in the state spends at least part of their lives in its estuaries.

The National Estuarine Research Reserve System provides researchers with a great living laboratory where they can become familiar with the systems they are studying. Grabowski took full advantage of this benefit by looking not only at the landscape setting but also at the habitat complexity of oyster reefs.

Grabowski's focus on conducting research with direct applications to management and industry communities has carried on past his academic career. In 2002 he traded the Carolina coast for Maine's rocky shore and is now a benthic ecologist with the Gulf of Maine Research Institute (GMRI).

He is part of an interdisciplinary team of ecologists, oceanographers, and economists addressing ecosystem approaches to fisheries research and management. Although he is working in a new system with different species (cod, monkfish, and lobster) he continues to investigate the importance of top-down vs. bottom-up processes in community dynamics.

While Grabowski has shifted his focus from restoration to fisheries, he is still investigating characteristics of juvenile fish. Specifically, he is studying how abundance and distribution of juvenile fish are influenced in response to habitat closures within the Gulf of Maine.

During his doctoral research Grabowski was quoted as saying, "Fisheries are a natural bridge between ecology and economics." Today, still building on the foundation of his Graduate Research Fellowship, he is doing just that, bridging ecology and economics through his work with GMRI.

Grabowski still maintains contact with many people at UNC Chapel Hill's Institute of Marine Science and has collaborated with other GRF alumni, including Dr. Jeb Byers and Dr. Lindsay Whitlow. Grabowski's valuable research at the Rachel Carson component of the North Carolina Reserve propagated an impressive list of publications in Ecology, Marine Ecology Progress Series, Oecologia, as well as an edited book chapter.



Katie Griffith, a doctoral student at the University of California, Santa Cruz, has a three-year fellowship to study the distribution and abundance of salt marsh dodder (*Cuscuta salina*) in a Elkhorn Slough NERR in California.



Dino Marshalonis, a doctoral candidate at the University of South Carolina, has a three-year fellowship to study the role of gelatinous zooplankton like this *Nemopsis bachei* in regulating estuarine plankton communities and carbon flows. He is conducting his research at the North Inlet-Winyah Bay NERR in South Carolina.



In-Young Yeo

Old Woman Creek 2002-2004

How do you stop something that comes at you from all directions, like the snakes in the pit in *Raiders of the Lost Ark*? Non-point source pollution is like that, which makes it one of the most intractable problems facing coastal managers around the country.

Indiana Jones's solution to the snakes was to ward them off with fire, and he eventually escaped with a lot of luck. Fire and luck are great solutions in movies, but in the real world, management solutions are much less spectacular.

More to the point, most land-use models to control storm run-off are developed at too large a scale to be fully effective. They rely on broad descriptions of land use and pollution sources, but they don't pay much attention to where various land uses are occurring.

In 2002, an Ohio State University graduate student named In-Young Yeo pondered the problem and wondered if she could develop a model that took into account not just what was being done on the land, but where it was being done. Such a model might help decision-makers improve stormwater management results through optimal land-use planning.

Yeo wanted to see if she could develop a land-use model to "identify and prioritize the locations that should be targeted for development and conservation to protect water resources." With support from a NOAA Graduate Research Fellowship, she developed a high-resolution land-use model that describes optimal land use for a given watershed and reduces peak run-off by 15-20 percent.

Yeo learned about NOAA's Graduate Research Fellowship program while working as graduate research assistant with the Ohio State Sea Grant Program.

For a project on the use of remotely sensed data to measure water quality, she was directed to David Klarer, the research coordinator at Old Woman Creek National Estuarine Research Reserve on Lake Erie, and she realized the 571-acre reserve might be the perfect laboratory to develop and test the land use model she had in mind.

Her idea was to divide a watershed into cells at high resolution (30-meters) and use geospatial data to characterize each by its soil type, land-use type, topography, and precipitation. Then actual storm run-off is measured to calibrate the model before applying the optimized model. If the model worked, it would "delineate optimal land-use patterns, identify priority areas and provide land-use guidelines for watershed protection," Yeo explained in a paper about the study.

"Dr. Klarer was a great resource," Yeo says. "He provided me with rich datasets, pointed me to previous work people have done in the field and coordinated meeting with local government officials to collect information about land use practices and management."

Yeo started by dividing a small catchment of the Old Woman Creek watershed into more than 1,700 cells and collected geographic information system data to describe each cell's soil type, surface water features, land use and elevation. She found that 79% of the land was in agricultural use, 13% in conservation land use (grass/wood), and all but one of the remaining cells was under water. The one exceptional cell was identified as urban, with a built-up structure. She found three types of soils, and the slope in cells ranged from negligible to 9.3%. Later she applied the same methodology to the entire watershed, with more than 73,000 cells.



She then made simulated changes in the cells to test how different land-uses would change the amount of peak run-off in various storm scenarios. In making changes, she retained the proportion of the different land uses, but changed the locations of those uses to obtain maximum water retention during a storm.

The result was an optimized land-use model for the Old Woman Creek watershed that reduced peak run-off into the stream (and by extension the oil, toxins, nutrients, metals and other pollutants that run-off carries) by 15-20 percent. Based on the model, which is a description of the ideal land-use distribution for the watershed, Yeo said she would recommend:

- allocating conservation land to areas with high infiltration capacity;
- reducing the urban and agricultural intensity around the stream with vegetation buffers;
- protecting upland watershed areas from development;
- and buffering urban areas with vegetation..

Yeo cautioned that her recommendations for the Old Woman Creek watershed are not necessarily global. The model should be applied to watersheds based on their unique characteristics, including the intensity of storms that might occur in different watersheds, since heavier storms can reduce the flow-reducing effectiveness of some land-use practices.

Yeo's work quickly caught the attention of professional land-use planners and academics. She published her first paper on it in *Earth Interactions*, a journal of the American Meteorological Society in 2004, as she was finishing her Ph.D. at Ohio State. She has subsequently published and presented nearly a dozen papers on the topic in a variety of peer-reviewed journals.

After a semester as a visiting assistant professor at Cornell University, Yeo was appointed to the geography faculty at the University of Maryland, College Park, where she is teaching GIS and continuing her research in environmental modeling and management and land-use optimization.



Inga P. La Puma, a doctoral candidate at Rutgers University, has a three-year fellowship to study the effects of fire and other disturbance in the watersheds of the estuary at the landscape scale. Working in the watershed of the Jacques Cousteau NERR in New Jersey, she recently did a survey to determine the post-fire proportion of seedlings vs. resprouts of pitch pine (*Pinus rigida*).



Rikke Kvist Preisler, a doctoral student at the University of California, Santa Cruz, is on a three-year fellowship studying distribution variations of the European green crab (*Carcinus maenas*) in its native and invaded ranges. For the invaded range, she is conducting her research at Elkhorn Slough NERR in California and at other reserves.

Yeo is generous with her praise for the Graduate Research Fellowship Program, which funded her studies at Old Woman Creek for two years.

“Without the GRF program, I couldn’t do a good dissertation,” she says. “I was able to fully focus on my research and to do quality work. The reserve has wonderful resources and is committed to education. The involvement of Dr. Klarer in my dissertation was critical to understand the study area, the data and the results.

“I think this is a wonderful opportunity for graduate students, yet it is relatively unknown. I am promoting the GRF program and asking graduate students to apply. More students and colleges need to know about this program,” she adds.

She also has some advice for would-be GRFs: “I think I was awarded this fellowship because I was already doing a small research project at Old Woman Creek, and I knew what the critical research agenda was. If you are interested, get started early and show your strong interests with your on-going research activity, even if it’s very small.”

Making an Impact



GRF's - Where they are now

Academia

Professors
Post Doctoral Researchers & Research Associates
Doctoral Candidates

Federal Government

NOAA - National Oceanic and Atmospheric Administration
Hollings Marine Laboratory
Community Based Restoration Program
National Marine Sanctuaries
Joint Institute for the Study of Atmosphere and Ocean
National Marine Fisheries Service
Assessment and Restoration Division
Northeast Fisheries Science Center
SeaGrant
EPA – Environmental Protection Agency
USGS – United States Geologic Survey
National Park Service

State Government

Fish and Wildlife
Natural Resources
Environmental Protection
NERRS
Manager, North Carolina
Education Coordinator, San Francisco Bay
Research Coordinator, Weeks Bay
Stewardship Coordinator, Elkhorn Slough
Field Researcher/SWMP Technician, Jacques Cousteau
Web Administrator, Chesapeake Bay Virginia

Non-Governmental Organizations & Private Companies

* Based on current available information regarding GRF alumni employment.

Carrie Yoder

Weeks Bay 2002

The ongoing product of scientific inquiry is legacy – the accretion of knowledge to which every scientist tries to contribute. The NERRS Graduate Research Fellowship Program is no exception. Every student who conducts research at a National Estuarine Research Reserve adds new knowledge to the broad field of estuarine science and to numerous narrower disciplines, from biology to hydrology.

Some researchers continue to contribute to the knowledge base over a career or a lifetime. Others have only brief moment, but they light a flame that others will not allow to go out. Such is the legacy of Carrie Lynn Yoder.

Yoder, a 26-year old doctoral candidate at Louisiana State University, had every reason to be optimistic about her contributions to knowledge of plant biology in March 2003. Just a few weeks earlier, she had passed her general examination and won approval of her research plan.

But on March 3, 2003, Carrie was abducted from her apartment in Baton Rouge and murdered by a serial killer who had terrorized the area for more than a year.

Carrie's death was obviously a tragedy for her family and many friends. Those same friends and family were determined that the work she had already done would build the legacy it deserved. Carrie Lynn Yoder's name now lives on in scholarships, seminars and in the dissertation her doctoral advisor finished for her.

Her advisor, Dr. William Platt, explains it best:

"Carrie began research as a Ph.D. graduate student at LSU on the interactive effects of disturbances, including sea level rise, hurricanes, fires, and human alterations of habitats on coastal transition landscapes in 2000 at the Weeks Bay NERR on the northern Gulf of Mexico coast.

"The data that Carrie obtained over her three-years of fieldwork at the Weeks Bay NERR have led to the development of a larger multi-disciplinary research project.

"This project, conducted by her major professor, Dr. Bill Platt (Louisiana State University),



"Dr. Loretta Battaglia (Southern Illinois University), Dr. Kam-biu Liu (Louisiana State University), and Dr. Julie Whitbeck (University of New Orleans), involves study of changes occurring along coastal transitions at Weeks Bay as a function of sea-level rise, hurricanes, and fire suppression.

"Carrie's study also has resulted in two graduate student research projects being conducted along her transect at the Weeks Bay NERR and two others at nearby coastal sites, including the Grand Bay NERR in Mississippi and St. Joseph Bay State Buffer Preserve in Florida.

"In December, 2006, a workshop was held at LSU in her honor to explore the research directions undertaken as a result of her pioneering efforts at the Weeks Bay NERR. Presentations were made by four faculty members and six students working on fields ranging from paleotempestology and historical ecology to hurricane ecology and mycorrhizal/rhizosphere ecology of coastal transitions.

"Two major hurricanes, Ivan (2004) and Katrina (2005) have affected Carrie's study area. The western part of the eye of Ivan crossed Weeks Bay and Carrie's transect with winds of 125 mph and a 20 foot storm surge. The entire transect was inundated as the eye crossed the site.

"One year later, Katrina pushed a wall of seawater across the site for 4-5 days, causing extensive inundation, salt damage, and deposition of extensive deposits of wrack.

“These hurricanes produced different effects, but together disassembled most of the forest and marsh ecosystems along the transect.

“These effects led to an NSF grant to study mechanisms of disassembly and reassembly along the coastal transition at Weeks Bay NERR. These studies have led to invitations to present seminars and prepare publications on the work for major international journals. Because the content of these papers will involve scientific data derived from the initial work done by Carrie, she will be included as an author on these papers.

“The research has expanded across the Gulf Coast. The transect at Weeks Bay NERR has stimulated installation of similar transects at other sites along the northern coast of the Gulf of Mexico, includingt Jean Lafitte National Historical Park (Jefferson Parish, LA), Grand Bay NERR & National Wildlife Refuge (Jackson County, MS), Weeks Bay NERR (Baldwin County, AL), and St. Joseph Bay State Buffer Preserve (Gulf County, FL) . Several others are in the planning stages.

“Data from all the transects are revealing large-scale changes in certain portions of the coastal transitions resulting from rapid sea level rise, and where hurricanes have occurred recently, the changes are extensive and pervasive along the entire elevation gradient, with extant ecosystems disassembled and new ones reassembling that were not present previously.

“All of this is Carrie’s legacy.”

Carrie Lynn Yoder
1976-2003



Jay Turnure, a doctoral student at Rutgers University, is in a two-year fellowship studying weakfish in the Jacques Cousteau NERR in New Jersey. He has been tagging fish with transmitters that will allow him to track the fish’s movements and activities for up to a year.



Chuan-Kai Ho, used a three-year fellowship while a doctoral student at the University of Houston to study plant-herbivore interactions at different latitudes and the impact of climate change. He conducted his research in several reserves around the country. He is seen here with his advisor, Dr. Steve Pennings, at ACE Basin NERR in South Carolina.

Carlos G. García-Quijano

Jobos Bay, 2003-2004

One of the raging controversies in many of the social sciences as they relate to the environment is the question of economic determinism – whether the primary motive behind behavior in the environment is profit. Carlos G. García-Quijano, then studying for his doctorate in anthropology at the University of Georgia, applied the question to a group of small-scale estuarine-reef fishers in southeastern Puerto Rico and came up with a surprising answer.

García-Quijano had studied marine ecology as an undergraduate biology major at the University of Puerto Rico - Mayaguez, and as he progressed through his graduate studies, he became interested in environmental social sciences, human ecology and small-scale fisheries.

“My interests became concentrated in areas of intense human-marine interactions,” García-Quijano explains. “This led me to study estuaries since estuaries are supremely important as places where people interact with the sea.”

The estuarine focus proved fortuitous in 2003, as García-Quijano discovered the existence of NOAA's Graduate Research Fellowship and the opportunity to conduct research in one or more of the then 25 National Estuarine Research Reserves around the country. He applied for a fellowship to study a population of small-scale estuarine-reef fishers and their communities in and around Jobos Bay Reserve on the south-east coast of Puerto Rico.

He explains that this community of fishers is an ideal study group because it operates within a complex multi-species tropical fishery, and it is complicated by regulatory and coastal development pressures.

The idea was to understand and document through research how these small-scale fishers use local ecological knowledge to achieve success. García-Quijano used both qualitative and quantitative approaches of ethnographic research. He first examined how fishers defined success and then how their local ecological knowledge helped them succeed.



The first surprise came in the fishers' definition of success, which turned out to be a multi dimensional phenomenon. The most widely shared goals among this population of fishers were: 1) social recognition as 'true fishers' and 2) making enough profit from fishing to ensure reproduction of the domestic unit (raise a family). Puerto Rican fishers operate in a social-ecological system characterized by great complexity and rapid change; thus achieving predictability and stability has a high premium, higher than that of simple economic profit. Achieving a good catch is, of course, still a component of the fishers' collective cultural model of success, but only insofar as it enables fishers to maintain a predictable income, raise a family and maintain social relationships of respect and reciprocity with other fishers.

This finding challenged the notion in other bio-economic models that assume fishers operate to maximize profit. This opened a new approach to future fisheries management models as they relate to regional management in areas such as Puerto Rico or areas with similar populations of small-scale fishers.

García-Quijano also found that fishers use their local ecological knowledge not only as a tool to succeed in fishing but also to make sense of the regulatory environment and understand the impacts of coastal development on their community and resource. The fishers have extensive knowledge of target species' biology, and they conceptualize the ecosystem in terms of ecological parameters such as species

assemblages, trophic structures, salinity, seasonality, and depth in relationship to the location, availability, and health of target species.

He also found that fishers possess valuable knowledge of trend data for species over space and time that is of value to the management community. Correlating environmental parameters with the capture success over time, fishers form “imagined underwater scenarios” to consider what kinds of fish might be found in a certain set of conditions. With this awareness, resource managers and scientists can build better relationships with the small-scale estuarine-reef fishers in a way that may lead to locally-adaptive fishery management.

Since receiving his Ph.D. in 2006, García-Quijano has accepted positions as a research associate and adjunct professor at the University of Puerto Rico's Institute for Interdisciplinary Research in Cayey. His research interests continue to contribute to the coastal communities of Puerto Rico and the Virgin Islands in many ways.

For instance, he is developing a series of workshops that will share his dissertation results with Puerto Rican fishers. In another project he is examining how social-ecological systems change in response to introduced species and the role that culture and media play in shaping people's responses to these species. He also has begun researching the contributions of land-crabbers in Puerto Rico and the Virgin Islands to the welfare and resilience of coastal communities.

Clearly, the interdisciplinary and applied nature of these projects will serve to benefit a wide range of population groups in the coastal zone, from policy makers and managers to anthropologists, scientists, and citizens in resource dependent communities. He also hopes his work will inform adaptive management and co-management approaches to coastal Caribbean environmental issues.



Jennifer Greene, used her one-year fellowship as a doctoral student at the University of New Hampshire to study oyster (*Crassostrea virginica*) restoration in the Great Bay NERR in New Hampshire. She is now working in the Jackson Estuarine Lab at UNH. Photo shows Greene and Ray Grizzle separating 10 million oyster larvae into two groups for remote setting.



David Gillett, a doctoral student at the Virginia Institute of Marine Science, is using his two-year fellowship to study how habitat degradation affects benthic secondary production and trophic transfer efficiency in unvegetated estuarine shallows at the Virginia Chesapeake Bay NERR. Gillett got some extracurricular experience in July 2007 when he helped to guide famed oceanographer Sylvia Earle and four participants in the National Geographic Society's Jason Project in the marshes of the Virginia Chesapeake Bay Reserve.



García-Quijano maintains contact with the Jobos Reserve through correspondence with both past and present research coordinators as well as past and present Graduate Research Fellows. He is also planning to engage in further research in the Jobos Reserve in the very near future.

Looking back, he has some advice for incoming fellows that echoes some of his findings about the values of the fishers he studied: "Take full advantage of the resources provided by the Reserves, not just the money. Probably the most valuable resource you will find is the experienced on-site reserve staff and the communities of people that live near the reserve."

Graduate Research Publications

The top peer-reviewed publications for known Fellows' articles are:

Ecology
Estuaries and Coasts
Journal of Ecology
Marine Ecology Progress Series
Oecologia
Wetlands Ecology and Management
Estuarine Coastal and Shelf Science
Biological Invasions
Journal of Coastal Research
Journal of Experimental Marine Biology and Ecology

Graduate Research Fellows' are published in a number of journals across a variety of fields, including American Anthropologist, Landscape Journal, and Environmental Pollution among others.

Graduate Research Fellows have investigated a number of topics over the last ten years including:

Non-Point Source Pollution
Habitat Restoration
Invasive Species
Biodiversity
Contaminants
Social Ecology
Nutrient Dynamics
Hydrology
Trophic Dynamics
Habitat Ecology
Climate Change
Recruitment
Nekton
Emergent Vegetation
Submerged Aquatic Vegetation
Primary and Secondary Production



Peter Clarke, then a University of Massachusetts master's student, studied winter recruitment of young-of-the-year bluefish (*Pomatomus saltatrix*), into Guana Tolomato Matanzas NERR in Northeast Florida, during his fellowship in 2004. Here he is seen working experimental gill nets during his project. Clarke is now a research specialist with Atlantic States Marine Fisheries Commission through the New Jersey Division of Fish and Wildlife.

Jeb Byers

Elkhorn Slough 1998-2000

Sometime around the start of the Great Depression, a subtle invading force from East Asia landed on the shores of the U.S. Pacific coast. The invaders were snails, and they took up residence in coastal marshes and wetlands, but few took much notice until the early 1990s.

That was about the same time that James E. (Jeb) Byers discovered his passion for mud, when he spent one semester studying at the Duke Marine Lab in Beaufort, NC, as an undergrad. The zoology major enjoyed his work so much that one of his first jobs after graduation was setting up, monitoring and analyzing experiments on subtidal oyster reefs as a lab tech at the neighboring University of North Carolina's Institute of Marine Science.

"I knew then that this was really what I was passionate about and wanted to do as a full-fledged researcher myself," Byers says. "I want to do work that helps to explain the natural world and also helps to solve some of the major conservation crises it currently faces."

Byers went west to do his graduate work at the University of California, Santa Barbara. There he learned about the invaders from 60 years earlier that were taking over marshes at various spots along the West Coast. He also learned about the new NOAA Graduate Research Fellowship program that could fund his efforts to learn about the invaders if he would do his research in one of the National Estuarine Research Reserves.

Byers began his work right away throughout northern California, and in 1998 was awarded a National Estuarine Research Reserve Graduate Research Fellowship to expand his work in Elkhorn Slough off Monterey Bay. By the end of 1999, he had completed his doctoral dissertation and was on his way to becoming one of the leading experts on the invasive Asian hornsnail (*Batillaria attramentaria*) and its effects on the native California hornsnail (*Cerithidea californica*).

Byers's ulterior motive was to "develop better predictive and quantitative frameworks" for studying the impacts of invasive species, one of the most complex and vexing problems facing ecologists today. The competing snails were perfect for his study.



"Snails have shells amenable to being painted and tagged, and they have large population sizes suitable for large-scale manipulations," Byers explains. "Another important aspect was that both species have closed populations, meaning juveniles grow up in the vicinity of their parents and don't drift off to sea in the plankton."

As a bonus, he notes, "Snails are known for being pretty docile."

So the young Graduate Research Fellow began combing the muddy marshes of Elkhorn Slough Reserve, reveling in the feeling of being outside in the mud on warm days, an antidote to spending nights sleeping on the cold concrete floor of the science lab. As observers wondered what he was doing out in the marsh (some actually asked if he was growing rice or looking for oil), he measured and collected snails to see what gave *Batillaria* such an advantage over *Cerithidea*.

Byers and Lloyd Goldwasser then did some mathematical modeling on the findings and determined that although *Batillaria*'s takeover had occurred slowly, it was inevitable from the start.

"Obviously, this has dramatic implications for programs designed to monitor the impacts of exotic species on natives," Byers says. "The effects can be extremely subtle and not detectable until decades after the initial invasion, well after the native species is on its way to inevitable decline."

Byers describes the snail work as "useful as a springboard for testing and developing general theory" about invasives. But he wasn't done.

A common question from non-scientists about his work kept nagging at him. “Why should we care if one mudsnail replaces another in the marsh?”

Byers gave standard answers about the inherent worth of species and biodiversity, and the impacts on the diatom food source and other organisms that depend on it, but the latter argument in particular “seemed a bit intangible, relying on too much speculation.”

Then he and two colleagues, Todd Huspeni and Mark Torchin, discovered something else about the differences between *Batillaria* and *Cerithidea*. It turns out that the invader harbors the larval stage of a parasitic trematode that does not infect the native. Conversely, up to a dozen trematode species that infect the native do not infect *Batillaria*. These trematodes all pass through the marsh food chain, all the way to shore birds and fish. They, too, play a vital role in the marsh ecosystem, and the native trematodes were being displaced along with the native snails.

“Obviously, *Batillaria* carried with it this hitchhiker species that was clearly affecting many organisms in the marsh directly,” Byers states. Ironically, *Batillaria* arrived in North America as a hitchhiker, too, riding along with Asian oysters when they were introduced to the U.S. West Coast.

Byers’s snail research propelled him through his doctoral dissertation and on to his current work as an associate professor of zoology at the University of New Hampshire, where he continues to do ecological research in marshes and estuaries, quantitatively measuring impacts of non-indigenous species on native biota in invaded marine communities. “Interactions with non-indigenous species are a leading cause of endangerment and extinction of native species,” he adds.

Byers has published eight peer-reviewed papers directly related to his work as a GRF, and another two dozen papers and book chapters on related research on interactions between invasive species and natives in coastal wetlands environments.

His ongoing work keeps him in touch with the National Estuarine Research Reserve System and the Graduate Research Fellowship Program. Two of his graduate students, Aaren Freeman and Jean Lee, have become GRFs themselves, working in the Great Bay Reserve.



He works closely with Kathy Mills, research coordinator at Great Bay NERR in New Hampshire, and with Michelle Dionne, research coordinator at Wells NERR in Maine. Dionne is even helping to advise one of Byers’s graduate students. He also maintains close contact with Kerstin Wasson, whom he met when both were doing research at Elkhorn Slough. “She came up to me when I was working in the mud and filled me in on the details of a project – we’ve been friends and colleagues since.”

Wasson, now the research coordinator at Elkhorn Slough, says, “Jeb’s career exemplifies what the GRF program is all about, supporting students on a trajectory from stellar graduate work to professional careers in estuarine science.”

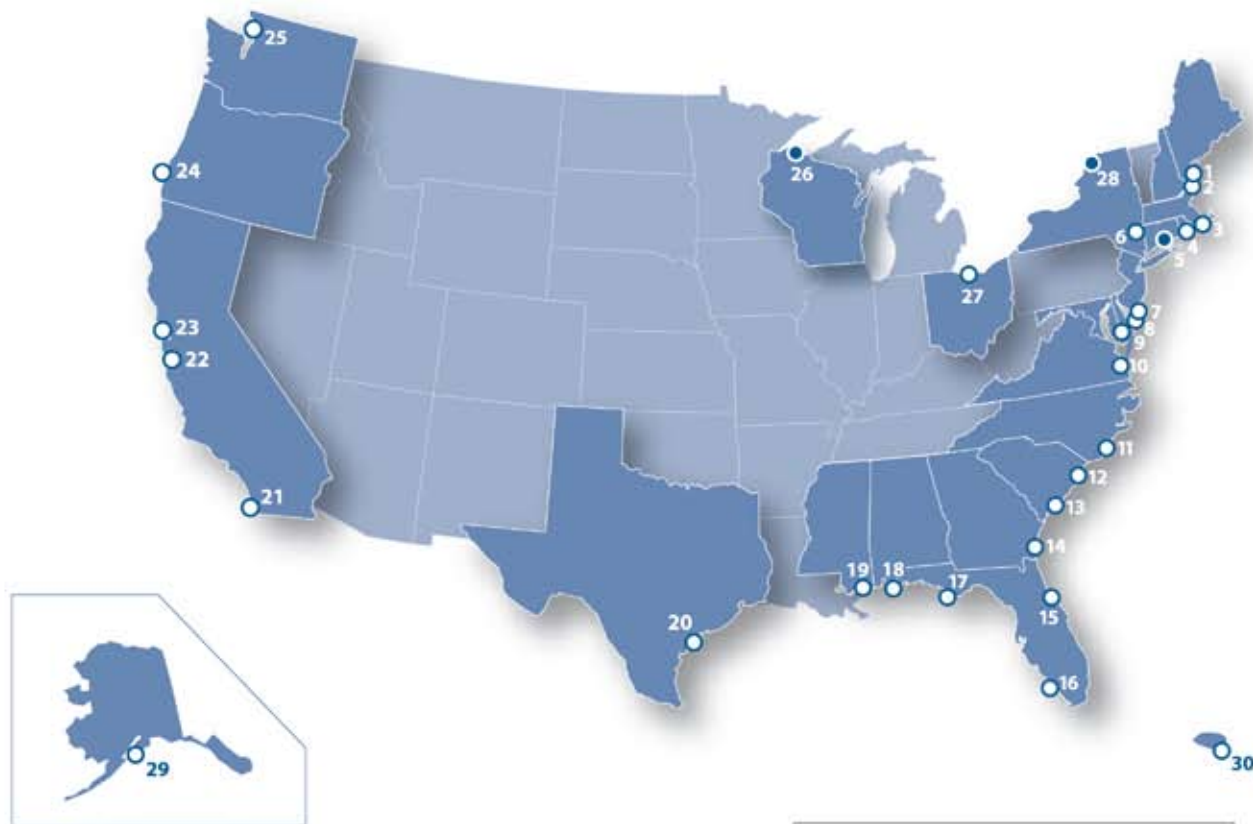
Alumni

Eric Anderson	2003	Padilla Bay	Angela Gospodarek	1997	Hudson River
Peter Adams	2003	Kachemak Bay	Yogani Govender	2007	Jobos Bay
Andrew Altieri	2001	Narragansett Bay	Jonathon Grabowski	1997	North Carolina
Jude Apple	2000	Chesapeake Bay MD	Aaliyah Green	2006	North Carolina
John Baker	2001	Guana Tolomato Matanzas	Jason Gregory	2006	Ace Basin
Ermelindo Banchs Plaza	1997	Jobos Bay	Jennifer Greene	2003	Great Bay
Boaz Barak	2004	Waquoit Bay	Katie Griffith	2005	Elkhorn Slough
David Beard	2000	Narragansett Bay	Christine Gwaltney	2003	Rookery Bay
Michael Berger	2001	South Slough	Richard Gwozdz	2004	Padilla Bay
Genevieve Bernatchez	2006	Wells	Jennifer Haag	2004	Jacques Cousteau
Jennifer Beseres	2003	North-Inlet Winyah Bay	Daniel Hahn	1999	Padilla Bay
Everett Bonniwell	1997	Old Woman Creek	Robert Haney	2004	Wells
Brian Boutin	2005	Delaware	Deborah Harrington	1997	Apalachicola
Jennifer Bowen	2001	Jobos Bay	Neil Harrington	1997	Elkhorn Slough
Catherine Bozek	2002	Great Bay	Mary Jo Hartman	2000	North-Inlet Winyah Bay
Ross Brittain	2006	Sapelo Island	Elizabeth Harvey	2006	Padilla Bay
Keryn Bromberg	2007	Narragansett Bay	Susanne Hauswaldt	2001	Ace Basin
Jennifer Brown	2000	Elkhorn Slough	Jennifer Hauxwell	1997	Waquoit Bay
Jill Brown	2005	Delaware	Brian Hedlund	1997	Padilla Bay
John Bruno	1997	Narragansett Bay	Edward Hegnauer	1999	Chesapeake Bay MD
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Helen Bustamante	2005	Hudson River	Eric Hellquist	2000	Padilla Bay
James Byers	1998	Elkhorn Slough	Sarah Hemmings	2005	Sapelo Island
Jessie Campbell	2005	Chesapeake Bay VA	Astrid Hernandez	1997	Jobos Bay
Andy Canion	2005	Weeks Bay	Margot Hessing-Lewis	2007	South Slough
Mark Capone	2005	Great Bay	Chuan-Kai Ho	2004	Ace Basin
Meredith Carr	2001	Hudson River	Amanda Hollebhone	2003	Sapelo Island
John Cartwright	2000	Weeks Bay	Emily Howe	2006	Padilla Bay
Michael Castellano	2007	Chesapeake Bay MD	Meghan Huges	2004	Grand Bay
Todd Chadwell	2004	Chesapeake Bay MD	Glendon Hunsinger	2007	Hudson River
Hao-Hsien Chang	2005	Narragansett Bay	Laura Jacobs	2005	Old Woman Creek
Heloise Chenelot	2000 & 2001	Kachemak Bay	Mathew James	1997	Tijuana River
Carl Childs	2000	Apalachicola	Juan Jimenez	2007	Mission-Aransas
Giancarlo Cicchetti	1997	Chesapeake Bay VA	Wesley Johnson	2001	North-Inlet Winyah Bay
Peter Clarke	2004	Guana Tolomato Matanzas	Katrina Johnston	2007	Ace Basin
Sara Connors	1999	Elkhorn Slough	Amanda Jones	1999	Jobos Bay
Tenley Conway	2001	Jacques Cousteau	Kerri Kidder	2004	South Slough
D. Reide Corbett	1997	Apalachicola	Erin Kinney	2005	Waquoit Bay
Guido Como	2003	Kachemak Bay	Carrie Kopin	1999	Delaware
Angela Coulliette	2006	North Carolina	Kevin Kroeger	2000	Waquoit Bay
Richard Cowlshaw	1998	South Slough	Kristy Kroeker	2006	Narragansett Bay
Ben Daly	2005 & 2006	Kachemak Bay	Amy Kulesza	2004	Old Woman Creek
Anthony D'Andrea	1997	North-Inlet Winyah Bay	Inga La Puma	2007	Jacques Cousteau
Forbes Darby	1997	Delaware	Melissa Lage	2004	Wells
Timothy Davidson	2007	South Slough	Johnny Lancaster	1997	North Carolina
Sarah Davies	2003	Chesapeake Bay VA	Gabriel Langford	2006	Grand Bay
Deborah DiQuinzio	1997	Narragansett Bay	David Lawrence	1999	Waquoit Bay
Nicole Dix	2006	Guana Tolomato Matanzas	Michael League	2003	Delaware
Monica Dozier	2000	North Carolina	Wan-Jean Lee	2007	Great Bay
Donna Drury	2000 & 2002	Grand Bay	Richard Lehnert	1999	North-Inlet Winyah Bay
Jon Duke	2004	Narragansett Bay	John Lehrter	2000	Weeks Bay
Henrietta Dulaiova	2003	Apalachicola	Sue Leitholf	2004	Guana Tolomato Matanzas
Adrienne Dunsmuir	2001	Weeks Bay	Scott Lerberg	2000	Chesapeake Bay VA
Matthew Dvorak	2004	Rookery Bay	Zhijun Liu	2004	Grand Bay
Alyson Eberhardt	2002	Wells	David Love	2006	North Carolina
Rebecca Ellin	1999	North-Inlet Winyah Bay	Hem Nalini Morzarie Luna	2000	Tijuana River
William Ellis	1998	Rookery Bay	Scott Lynn	2002	Old Woman Creek
Gregory Ellis	2006	Rookery Bay	Mark Lyons	2007	Old Woman Creek
Patrick Ewanchuck	1998	Wells	Bonnie Mallory	1998	Hudson River
Benjamin Fertig	2006	Chesapeake Bay MD	Justin Manley	2004	Sapelo Island
Kitty Fielding	2006	Chesapeake Bay MD	Daniel Marshalonis	2005	North-Inlet Winyah Bay
Sophia Fox	2003	Waquoit Bay	Michael Martinez	2007	Jobos Bay
Steve Franks	2000	Rookery Bay	Edward Martino	1999	Jacques Cousteau
Aaren Freeman	2002	Great Bay	Tara Martz	1997	Old Woman Creek
Carlos Garcia-Quijano	2003	Jobos Bay	Sacha Maxwell	2002	Padilla Bay
Jian Geng	2007	Rookery Bay	Lauren McChesney	2006	Chesapeake Bay MD
Thomas Gihring	2005	Apalachicola	Arja McCray	1999	Tijuana River
David Gillett	2006	Chesapeake Bay VA	Lauren McDaniel	2002	Rookery Bay
Sarah Good	2003	Waquoit Bay	Catherine McGlynn	2001	Hudson River
Cara Gormally	2007	Sapelo Island			

Alumni

Amanda McQuirk	2003	Jacques Cousteau	Lara Tikkanen	1999	Tijuana River
Mary Menconi	1999	Great Bay	Jaimie Tirado	2005	Jacques Cousteau
Sean Menke	2004	Tijuana River	Gabrielle Tomasky	2000	Waquoit Bay
Stephanie Micucci	1998	Old Woman Creek	Dawn Trexel	2000	Old Woman Creek
Eric Milbrandt	1998	South Slough	Lisa Turnbull	2004	South Slough
Jessica Miller	2001	South Slough	Jason Turnure	2007	Jacques Cousteau
Christine Mingione	2007	Waquoit Bay	Bilge Tutak	2007	Guana Tolomato Matanzas
Milan Mitrovich	2001	Tijuana River	Megan Tyrrell	1998	Great Bay
Rae Mooney	2007	Mission-Aransas	Vinton Valentine	1997	Delaware
Pamela Morgan	1997	Great Bay	Krista Van Amerongen	1999	Weeks Bay
Serena Moseman	2005	Tijuana River	Eileen Vandenberg	2001	North Carolina
Caitlin Mullan	2001	Wells	Robert Vincent	2006	Wells
Anne Mundel	2003	Delaware	Paige Vollmer	2004	Ace Basin
Megan Murphy	2007	Kachemak Bay	Sam Walker	2003	North-Inlet Winyah Bay
Ashley Murphy	2001	Guana Tolomato Matanzas	Weihong Wang	2007	North-Inlet Winyah Bay
Adam Murrah	2006	Weeks Bay	Scott Wankel	2003	Elkhorn Slough
Janet Nestlerode	1999	Chesapeake Bay VA	Landon Ward	2001	Chesapeake Bay VA
Scott Neubauer	1999	Chesapeake Bay VA	Kristen Ward	1998	Tijuana River
Melissa Neuman	1997	Jacques Cousteau	Elizabeth Watson	2005	San Francisco Bay
Christopher Nietch	1997	Ace Basin	Stacy Webb	1998	Sapelo Island
Stefka Nikolova	1997	North-Inlet Winyah Bay	Heidi Weiskel	2005	San Francisco Bay
Gregory Noe	1997	Tijuana River	Erica Westerman	2006	Great Bay
Karyn Novakowski	2001	North-Inlet Winyah Bay	David White	2000	North-Inlet Winyah Bay
Lucie Novoveska	2004	Weeks Bay	William Lindsay Whitlow	1999	Wells
Lucie Novoveska	2007	Weeks Bay	Tracy Wiegner	1999	Jacques Cousteau
Megan O'Connor	2006	Hudson River	Nishanthi Wijekoon	2005	Old Woman Creek
Andrew Ohana-Richardson	2005	South Slough	Bartholomew Wilson	2001	Delaware
Ylva Olsen	2004	Jobos Bay	Edward Woch	2004	Tijuana River
Rosa Suhey Ortiz	2007	Jobos Bay	Marjorie Wonham	1997	Padilla Bay
Sherry Palacios	2000	Elkhorn Slough	Eric Wooden	1998	Chesapeake Bay VA
James Palardy	2006	Kachemak Bay	Andrea Meyer Woolfolk	1997	Elkhorn Slough
Frank Parker	2005	Chesapeake Bay VA	Kathy Worley	2001	Rookery Bay
Alex Parker	2000	Delaware	In-Young Yeo	2002	Old Woman Creek
Charlyn Partridge	2007	Weeks Bay	Carrie Yoder	2002	Weeks Bay
Richard Peterson	2005	Apalachicola	Joanna York	2001	Tijuana River
Karen Phemister	2003	Chesapeake Bay MD	Jennifer Zelenke	1997	Chesapeake Bay MD
Scott Phipps	1997	Weeks Bay			
Abnery Picon	2000	Jobos Bay			
Kristy Pisani	2003	Weeks Bay			
Jennifer Plett	2002	Kachemak Bay			
Rikke Kvist Preisler	2006	Elkhorn Slough			
Jennifer Putland	2002	Apalachicola			
Christina Richards	2001	Sapelo Island			
Toby Rickabaugh	1997	Rookery Bay			
David Rivers	2004	Great Bay			
Mark Roberts	2007	Ace Basin			
Hudson Roditi	1997	Hudson River			
Jocelyn Romano	2004	North Carolina			
Jill Rooth	1997	Chesapeake Bay MD			
Dana Rowles	2003	Jacques Cousteau			
Scott Rush	2007	Grand Bay			
Gregg Sakowicz	2001	Jacques Cousteau			
Anne Salomon	2001	Kachemak Bay			
Guillermo Sanchez	2001	Grand Bay			
Elizabeth Saunders	2007	North Carolina			
James Schneider	1999	Apalachicola			
Gregory Schultz	1998	Sapelo Island			
William Seufzer	1997	Chesapeake Bay VA			
Virginia Shervette	2003	Weeks Bay			
Kelly Shotts	1997	Weeks Bay			
Gregory Shriver	2000	Great Bay			
Brian Silliman	2000	Narragansett Bay			
Angela Slagle	2002	Hudson River			
Wendy Sproull	1997	Waquoit Bay			
P.V. Sundareswarar	1998	Ace Basin			
Donna Surge	1998	Rookery Bay			
Doug Taylor	2002	Ace Basin			
Jeremy Testa	2005	Chesapeake Bay MD			
Craig Thompson	2000	Hudson River			
Merrilee Thoresen	2000	Sapelo Island			

estuarine research reserves



1. Wells, Maine
2. Great Bay, New Hampshire
3. Waquoit Bay, Massachusetts
4. Narragansett Bay, Rhode Island
5. Connecticut *
6. Hudson River, New York
7. Jacques Cousteau, New Jersey
8. Delaware
9. Chesapeake Bay, Maryland
10. Chesapeake Bay, Virginia
11. North Carolina
12. North Inlet-Winyah Bay, South Carolina
13. ACE Basin, South Carolina
14. Sapelo Island, Georgia
15. Guana Tolomato Matanzas, Florida

16. Rookery Bay, Florida
17. Apalachicola, Florida
18. Weeks Bay, Alabama
19. Grand Bay, Mississippi
20. Mission-Aransas, Texas
21. Tijuana River, California
22. Elkhorn Slough, California
23. San Francisco Bay, California
24. South Slough, Oregon
25. Padilla Bay, Washington
26. Wisconsin *
27. Old Woman Creek, Ohio
28. St. Lawrence River, New York *
29. Kachemak Bay, Alaska
30. Jobos Bay, Puerto Rico

* Proposed Reserve

To Apply

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